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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/591,565	05/07/2007	Joachim Koehler	Umicore 0169-US	6226

80336 7590 10/13/2011

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EXAMINER	
PARSONS, THOMAS H	

ART UNIT	PAPER NUMBER
1729	

MAIL DATE	DELIVERY MODE
10/13/2011	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/591,565	KOEHLER ET AL.	
	Examiner	Art Unit	
	THOMAS PARSONS	1729	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 August 2011*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5)☒ Claim(s) *1-3,5 and 11-19* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-3, 5 and 11-19* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

12)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Response to Amendment

This is in response to the Amendment filed 16 August 2011.

(*Previous*) DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The rejections of claim 3 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention has been withdrawn in view of Applicants' Amendment.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-3, 5, 11-17 and 20 **stand** rejected under 35 U.S.C. 103(a) as being unpatentable over EP 1 229 600 (hereafter EP '600) in view of Yamamoto et al. (US 6,797,426).

Claim 1: EP '600 in Figures 5 and 10 disclose a membrane electrode unit (17 07 35)for membrane fuel cells, comprising an ion-conducting membrane (15 or 34), at least one anode electrode layer (16 or 33), at least one cathode electrode layer (16 or 33), at least one porous, water repellent gas diffusion layer (11 or 31) mounted on the anode side and at least one porous,

water repellent gas diffusion layer mounted on the cathode side (11 or 31)(paragraphs [0003], [0024]-[0025], [0033], [0049]-[0050]),

wherein the total pore volume of the cathode gas diffusion layer is higher than the total pore volume of the anode gas diffusion layer ($V_{Cathode} > V_{Anode}$)(paragraphs [0074]-[0076] and [0039]-[0040]). ***See also entire document.***

EP '600 does not disclose that

the amount of water repellent agent in the anode and the cathode gas diffusion layer is in the range of 20 to 35% by weight (based on the total weight of the gas diffusion layer), and

the amount of water repellent agent in the anode gas diffusion layer is identical or higher than the amount of water repellent agent in the cathode gas diffusion layer ($WRA_{Anode} \geq WRA_{Cathode}$),

wherein the gas diffusion layers on the anode side and or the cathode side comprise a microlayer with a layer thickness between 10 and 20 microns.

Yamamoto et al. disclose that

the amount of water repellent agent in the anode and the cathode gas diffusion layer is in the range of 20 to 35% by weight (based on the total weight of the gas diffusion layer) (col. 1: 65-col. 2: 3), and

the amount of water repellent agent in the anode gas diffusion layer is identical or higher than the amount of water repellent agent in the cathode gas diffusion layer ($WRA_{Anode} \geq WRA_{Cathode}$) (col. 3: 58-65),

wherein the gas diffusion layers on the anode side and or the cathode side comprise a microlayer with a layer thickness between 10 and 20 microns (col. 5: 59-63, col. 4: 6-11, col. 8: 37-42 and 53-58). ***See also entire document***.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the membrane electrode unit of EP '600 by incorporating the amount of water repellent agent and the microlayer of Yamamoto et al.

One having ordinary skill in the art would have been motivated to make the modification to provide a fuel cell having an improved cell output.

The recitation "operating with dry, unhumidified gases" has been considered and construed as a process limitation that adds no additional structure to the fuel cell. However, because the structure of the EP '600 combination is the same as that instantly recited, the fuel cell of the EP '600 combination appears capable of operating with dry, unhumidified gases.

Claim 2: The EP combination does not disclose the total pore volume of the gas diffusion layer on the cathode side ($V_{Cathode}$) is in the range from 1.0 to 2.5 ml/g and the total pore volume of the gas diffusion layer on the anode side (V_{Anode}) is in the range from 0.5 to 2.0 ml/g.

In particular, EP '600 discloses that it is effective that a gas permeability of the conductive porous base material in the cathode is 1.2 to 2.0 times a gas permeability of the conductive porous base material in the anode. And, that it is effective that a porosity of the conductive porous base material in the cathode is 1.2 to 2.0 times a porosity of the conductive porous base material in the anode.

Therefore, it would have been within the skill of one having ordinary skill in the art at the time the invention was made to have modified the total pore volume of the membrane electrode unit of the EP '600 combination to provide the claimed total pore volume.

One having ordinary skill in the art would have been motivated to make such a modification to provide an improved polymer electrolyte fuel cell having a high discharge characteristic or more specifically a high current-voltage characteristic in a high current density range by optimizing water repellency, thereby improving the overall performance of the fuel cell (see EP '600, paragraph [0032]).

Claim 3: The rejection is as set forth above in claim 1 wherein Yamamoto et al. further disclose that the water repellent agent comprises fluorinated polymers such as PTFE (col. 3: 36-40).

Claim 5: EP '600 discloses that the ion-conducting membrane comprises a proton-conducting polymer materials (i.e. Nafion 112)(paragraph [0092]).

Claim 11: EP '600 discloses that the proton-conducting polymer material comprises tetrafluoro-ethylene/fluorovinyl ether copolymers (i.e. Nafion 112)(paragraph [0092]).

Claim 12: EP '600 discloses that the tetrafluoro-ethylene/fluorovinyl ether copolymer has sulphonic groups (i.e. Nafion 112)(paragraph [0092]).

Claim 13: EP '600 discloses that the electrode layers comprise a catalytically active, finely divided noble metal (col. 3: 32-36) (see also Yamamoto et al., col. 6: 23-col. 7: 10 and col. 8: 65-col. 8: 25).

Claim 14: EP '600 discloses that the noble metal is platinum (col. 3: 32-36) (see also Yamamoto et al., col. 6: 23-col. 7: 10 and col. 8: 65-col. 8: 25).

Claim 15: EP '600 discloses that the membrane electrode unit further comprises a seal material (paragraph [0072].

Claim 16: EP '600 discloses reinforcing materials for gas-tight sealing on installation in membrane fuel cell stacks (paragraph [0112]).

Claim 17: The rejection is as se forth above in claim 1 wherein further EP '600 discloses a membrane fuel cell stack comprising the membrane electrode unit.

4. Claims 18-19 **stand** rejected under 35 U.S.C. 103(a) as being unpatentable over EP 1 229 600 (hereafter EP '600) in view of Yamamoto et al. as applied to claim 1 above, and further in view of Iwase et al. (6,245,453).

EP '600 and Yamamoto et al. are as applied, argued, and disclosed above, and incorporated herein.

Claim 18: The EP '600 combination discloses a process of operating a fuel cell stack with wet, humidified operating gases (paragraph [0115]) comprising a membrane fuel cell stack comprising the membrane electrode unit set froth above in claim 1.

The EP '600 combination does not disclose operating with dry, unhumidified gases.

Iwase et al. disclose a process for operating a membrane fuel cell stack with dry, unhumidified operating gases, and wet gases (col. 12: 19-23 and 34-44 and col. 12: 64-col. 13: 4).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the process of the EP '600 combination by substituting the wet gas with the dry gas of Iwase et al.

One having ordinary skill in the art would have been motivated to make such a modification because Iwase et al. teach operating a membrane fuel cell stack with dry, unhumidified gas that would have provided superior characteristics over all range of current density, and an improvement in the prevention of the dry-up of the electrolyte film (col. 12: 34-44) thereby improving the overall performance of the fuel cell.

Claim 19: The rejection of claim 10 is as set forth above in claim 9 wherein Iwase et al. further disclose that the dry, unhumidified gases comprise hydrogen and oxygen.

Response to Arguments

5. Applicant's arguments filed 16 August 2011 have been fully considered but they are not persuasive.

I. On page 7, the Applicants argue "…First of all, there is no specific disclosure directing the skill person to fuel cells that operate with dry, unhumidified gases and without external humidifiers - as required by the claims. EP "600 is silent as to this aspect and Yamamoto shows no preference (see Yamamoto, col. 15, lines 36-39). Thus combining the references would not teach or suggest the claimed field of fuel cells that operate with dry, unhumidified gases."

In response,

A. The argument is not commensurate in scope with the claim as independent claim 1 is directed toward an apparatus whereas the applicant is arguing a process and/or a functional limitation.

B. While features of an apparatus may be recited either structurally or functionally, claims directed to an apparatus must be distinguished from the prior art in terms of structure rather that function. **In re Schreiber**, 128 F.3d 1473, 1477-78, 44 USPQ2d 1429, 1431-31 (Fed. Cir 1997). See also MPEP 2114.

C. A claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitation of the claim.

D. The recitation "operating with dry, unhumidified gases" has been considered and construed as a process or a functional limitation that adds no additional structure to the fuel cell. However, because the structure of the EP '600 combination is the same as that instantly recited, the fuel cell of the EP '600 combination appears capable of operating with dry, unhumidified gases.

II. On page 7, the Applicants argue "Furthermore, the claim element requiring that 'amount of water repellent agent in the anode gas diffusion layer is identical or higher than the amount of water repellent agent in the cathode gas diffusion layer' would be missing. Since the references have contradictory teachings in this regard (one teaching that the cathode has a higher water repellency, while the other teaches that the anode has a higher water repellency), it is unclear how their combination would teach or suggest to one of ordinary skill, the claim element requiring that amount of water repellent agent in the anode gas diffusion layer is identical or higher than the amount of water repellent agent in the cathode gas diffusion layer.

A. In response to applicant's argument that there is no teaching, suggestion, or motivation to combine the references, the examiner recognizes that obviousness may be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988), *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992), and *KSR International Co. v. Teleflex, Inc.*, 550 U.S. 398, 82 USPQ2d 1385 (2007). In this case,

EP '600 discloses

a water repellency of ***at least one*** of the cathode and the anode varies in a thickness or in a plane direction (paragraph [0033]).

"In this application, it is effective that the water repellency of the conductive porous base material varies in the direction of thickness and is higher on a side of the conductive separator plate than on a side of the hydrogen ion conductive polymer electrolyte membrane (paragraph [0035] and [0056]).

"…a water repellency of the carbon particles included in the gas diffusion layer is higher than the water repellency of the carbon particles included in the catalyst layer, and the water repellency of ***at least one*** of the cathode and the anode varies in the direction of thickness (paragraph [0042]).

The present invention provided a polymer electrolyte fuel cell in which distributions of water repellency of anode and cathode are regulated, so as to smooth the flows of gas and water

content inside the fuel cell and thereby prevent easy deterioration of the cell performances (paragraph [00480]).

Thus, the disclosure in EP '600 suggests that the water repellency can be regulated in the thickness direction such that the water repellency in the anode is higher than that in the cathode, that the water repellency in the anode and cathode can be the same, or that the water repellency in the cathode is higher that that in the anode.

Yamamoto et al. disclose that the amount of water repellent agent in the anode gas diffusion layer is identical or higher than the amount of water repellent agent in the cathode gas diffusion layer ($WRA_{Anode} \geq WRA_{Cathode}$) (col. 3: 58-65).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the membrane electrode unit of EP '600 by incorporating the amount of water repellent agent of Yamamoto et al.

One having ordinary skill in the art would have been motivated to make the modification as both EP '600 and Yamamoto et al. are concerned with improving cell performance (EP '600 is concerned with providing fuel cell with enhanced output whereas Yamamoto et al. is concerned with providing a fuel cell with a high discharge characteristic in a high current density range) and Yamamoto et al. teach distributions of water repellency of anode and cathodes that are regulated, so as to smooth the flows of gas and water content inside the fuel cell and thereby prevent easy deterioration of the cell performances.

Also, EP '600 is concerned with the problem of flooding of the cathode gas diffusion layer in a polymer electrolyte fuel cell. Yamamoto et al. are also concerned with flooding of the cathode gas diffusion layer in a polymer electrolyte fuel cell.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the fuel cell of EP '600 by incorporating the water repellent features of Yamamoto et al. as both are concerned with solving the same problem (i.e. flooding the cathode diffusion layer).

III. On pages 7-8 the Applicants argue that claim 1 of the present application requires that the amounts of water repellent agent in the anode and the cathode gas diffusion layers be in the range of 20 to 35% by weight (based on the total weight of the gas diffusion layer). Neither EP '600 nor Yamomoto teaches this claim element. As pointed out by the Examiner, EP '600 fails to disclose this element (see page 4, last paragraph, of the Office Action). Yamomoto, on the other hand, gives a very broad range of 20 to 80 wt.% for the anode and a range of 15 to 65 wt.% for the cathode (see Yamamoto, col. 1, line 65 to col. 2, line 3, and claims 5 and 6). There is nothing in Yamamoto that would direct one of ordinary skill to use an amount of water repellency in the gas diffusion layers in the range of 20- 35% by weight.

In response,

In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990) (The prior art taught carbon monoxide concentrations of "about 1-5%" while the claim was limited to "more than 5%." The court held that "about 1-5%" allowed for concentrations slightly above 5% thus the ranges overlapped.); In re Geisler, 116 F.3d 1465, 1469-71, 43 USPQ2d 1362, 1365-66 (Fed.

Cir. 1997) (Claim reciting thickness of a protective layer as falling within a range of "50 to 100 Angstroms" considered prima facie obvious in view of prior art reference teaching that "for suitable protection, the thickness of the protective layer should be not less than about 10 nm [i.e., 100 Angstroms]." The court stated that "by stating that suitable protection' is provided if the protective layer is about' 100 Angstroms thick, [the prior art reference] directly teaches the use of a thickness within [applicant's] claimed range.").

"[A] prior art reference that discloses a range encompassing a somewhat narrower claimed range is sufficient to establish a prima facie case of obviousness." In re Peterson, 315 F.3d 1325, 1330, 65 USPQ2d 1379, 1382-83 (Fed. Cir. 2003). >See also In re Harris, 409 F.3d 1339, 74 USPQ2d 1951 (Fed. Cir. 2005)(claimed alloy held obvious over prior art alloy that taught ranges of weight percentages overlapping, and inmost instances completely encompassing, claimed ranges; furthermore, narrower ranges taught by reference overlapped all but one range in claimed invention). See also MPEP, 2144.05.I.

IV. On page 8 the Applicants argue that the claim element requiring that the gas diffusion layers on the anode side or the cathode side comprise a microlayer having a layer thickness between 10 and 20 microns is not taught or suggested by the references - either alone or in combination. As pointed out by the Examiner, EP '600 fails to teach this claim element at all (see page 5 of the Office Action). In Yamamoto, Figure 1 shows the fuel diffusion layers (42) and (52), each comprise one or two microlayers (anode: 423 and 422; cathode: 522 and 523). Yamamoto discloses a very broad range for the layer thickness of the microlayer (2 to 100 microns) and teaches that the thickness of the microlayer is "not particularly limited" (see

Yamamoto, col. 5, lines 59-63). Thus there is no incentive or suggestion in either reference to use a microlayer having a layer thickness of 10-20 microns - as required by the claims.

In response, see response in paragraph III above.

V. On pages 8-9 the Applicants argue that Iwase teaches the use of dry gases as an option to humidified gases. Both operating conditions are reported. It should be noted, however, that the described dry gas operation of lwase still requires a humidity of the fuel gas of 100% -- only the air side (cathode side) is not humidified. See Iwase, col. 12, lines 40-45; specifically, line 44-45: "... using dry gas (humidity of the fuel gas and oxygen-containing gas were 100% and 30% respectively)". Thus the skilled person upon reading Iwase would not consider "providing or feeding dry, unhumidified gases to the anode and cathode of the membrane electrode unit" - as required by claim 18 (emphasis added). In the present invention unhumidified gases are fed to both the anode and the cathode side.

In response, The EP '600 combination discloses a dry, unhumidified gas. In particular, Yamamoto et al. in Figure 2 disclose a supply of hydrogen (921) and a supply of oxygen (93) that suggests a dry, unhumidified gas and Iwase et al. disclose a dry gas. Thus, the combination discloses feeding dry, unhumidified gases to the anode and cathode.

Conclusion

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Examiner Correspondence

Any inquiry concerning this communication or earlier communications from the examiner should be directed to THOMAS PARSONS whose telephone number is (571)272-1290. The examiner can normally be reached on M-F (7:00-3:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ula Ruddock can be reached on (571) 272-1481. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished

applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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